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**ORIGINAL
COMPLETE SPECIFICATION
STANDARD PATENT**

Invention Title: REFLECTIVE LAMINATE INSULATION PRODUCT

The following statement is a full description of this invention, including
the best method of performing it known to me:

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is quite high adding to transportation costs and making installation difficult. When the rolled product is installed in a wall or roof of a building, the roll of insulation material must be supported as the unfurled product is affixed to the wall or roof.

Accordingly, an object of the present invention is to provide a reflective insulation laminate product that is strong and yet light weight and is therefore easy to transport, handle and install.

The applicants have discovered that at least two different polymeric films having very different strength characteristics can be combined to produce a reflective insulation laminate sheet that overcomes the problems of the prior art. The overall strength characteristics of the laminate sheet make it suitable for use as a reflective insulation product yet the laminate sheet is still light weight.

Accordingly, in one embodiment the present invention provides a reflective insulation laminate sheet including;

- (1) one or more layers of a first polymeric material having a high bursting force value and a high tensile modulus value; and
- (2) one or more layers of a second polymeric material having a high propagation tear resistance value,

wherein at least one face of the laminated sheet has an infrared emittance not greater than 0.08 and the overall weight of the laminated sheet does not exceed 180 grams per square metre.

Throughout the description and claims of this specification the following definitions apply. A "bursting force value" of a material is that value as measured by Australian Standard 2001.2.19. A "tensile modulus value" of a material is that value as measured as 1% secant modulus by American Standard Test Method D882 in both the machine and transverse directions of the material. A "propagation tear resistance value" of a material is that value as measured by American Standard Test Method 1922 in both the machine and transverse directions of the material. A "edge tear resistance" value of material is that value is measured by Australian Standard 4200.1 in both the machine and transverse directions of the material.

The polymeric material that makes up the first layer or group of layers has a high bursting force value. This value is equal to or greater than 100 Newtons and more preferably equal to or greater than 200 Newtons. The material also has a high tensile modulus value which is equal to or greater than 15 kilonewtons per metre and more

It is preferable that the insulation sheet of this invention has a total weight of between 40 and 150 grams per square metre, more preferably not greater than 100 grams per square metre and most preferably about 80 grams per square metre.

The applicants have found that the preferred laminated sheet of the present
5 invention has a bursting force value greater than 200 Newtons, and an edge tear resistance value of more than 45 Newtons.

Preferably the insulation sheet consists of one layer of polymeric material selected from each of the two groups of polymeric materials noted above. However, the applicant has found that the number of layers is not critical to the performance of the invention. Accordingly the reflective sheet could include a number of layers
10 selected from each of the groups of polymeric materials. For example, the insulation sheet may include one layer of polymeric material selected from the first group (ie. oriented polyester, oriented polypropylene etc.), a second layer selected from the second group (ie. polyethylene etc.) and a further or third layer also selected from the first group wherein the final weight of the laminated sheet is below 180 grams per
15 square metre. In other words, the insulation sheet of this invention could be made of multiple layers selected from each of the groups of specified polymers, so long as the final weight of the layers is below the value specified above. Furthermore, where the insulation sheet includes such multiple layers, the applicants have found that the ordering of the layers is not critical to the performance of the invention.

As previously noted at least one face of the laminate product of this invention has an Infrared emittance of not greater than 0.08. Emittance is defined as the ratio of the thermal radiation from a unit area of a surface to the radiation from a unit area of a full emitter (black body) at the same temperature. Accordingly, the surface of the
20 laminate sheet of this invention having an infrared emittance of not greater than 0.08 not more than 8 percent of the amount of infrared radiation that a black body would emit at this same temperature. by having an emittance value of this magnitude, the laminate sheet of this invention is able to function effectively as a thermal insulator. Preferably, at least one face of the laminate sheet has an emittance of not greater than
25 0.05.

In a preferred embodiment, the reflective insulation sheet of this invention includes a further layer that confers the specified infrared emittance property on the insulation sheet. This further layer maybe a metal foil laminated to the aforementioned



500 ppm of Irganox 1010 can be incorporated into this polymer material. Irganox 1010 is an anti-oxidant manufactured by Ciba-Geigy.

It may be desirable to increase the tear resistance of the insulation sheet of this invention. This can be achieved by incorporating in the laminate a reinforcing fabric layer. Preferably this fabric is an open weave material such as scrim or mesh which can be trap laminated between two adjacent layers. Suitable fabric materials include glass filaments, nylon, polyester or other plastic material.

The layers of material that make up the insulation sheet of this invention can be laminated together by known techniques. For example, the layers can be laminated together using a hot melt adhesive or dry laminating adhesive which are well known in the laminating industry. A preferred dry laminating adhesive for use in this invention is an amine with an epoxide cross linker. As the insulation sheet of this invention is expected to have a long performance life, it is advantageous to use such an adhesive having a high content of epoxide cross linker so that the adhesive forms a very secure bond between adjacent layers of the laminate sheet. A suitable adhesive for use in this invention is Aquabond 444 manufactured by Morton. Alternatively, the polymeric layers can be thermally laminated together, thereby avoiding the use of adhesive.

In the manufacture of the Insulation sheet of the present invention it is preferable to arrange the polymer layers so that as they enter the laminating machine, the machine directions of these polymer layers are aligned and extend substantially parallel to the machine direction of the laminated sheet itself. By "substantially parallel" we mean extending in substantially the same direction. Consequently, this produces a laminated sheet wherein the machine directions of the polymeric layers of the sheet extend in substantially the same direction and also extend in substantially the same direction as the machine direction of the laminated sheet itself. For other known reflective insulation laminate sheets, adjacent layers of polymeric material enter the laminating machine at 45° to the machine direction of the laminated sheet. This produces a laminated sheet wherein the machine directions of the polymeric layers of the sheet are arranged at 90° to each other and at 45° to the machine direction of the laminated sheet. This constructional feature is relied upon to impart strength to the laminated sheet. If the machine directions of the polymeric layers of such laminate sheets were aligned and extended in the same direction as the machine direction of the laminate sheet, the final product would have insufficient strength to adequately perform

Preferred embodiments of the invention are hereinafter described with reference to the accompanying drawings in which:-

Figure 1 is one embodiment of the reflective insulation sheet of this invention including an aluminium foil sheet.

5 Figure 2 is a second embodiment of the reflective sheet insulation sheet of this invention including an aluminium vacuum deposit layer.

Figure 3 is a further embodiment of the reflective insulation sheet of this invention including reinforcing mesh.

10 Figure 1 shows a laminate product of this invention (1) including an aluminium foil layer (2), adhesive layers (3), an oriented polyester or polypropylene layer (4) and a polyethylene layer (5). The overall weight of this laminate product is as follows:

aluminium foil layer - 17 grams per square metre;
adhesive layer - 3 grams per square metre;
oriented polyester or polypropylene layer - 17 grams per square metre;
adhesive layer - 3 grams per square metre;
polyethylene layer - 40 grams per square metre;
TOTAL - 80 grams per square metre.

20 The laminate product illustrated in Figure 1 was tested and was found to have a bursting force value as measured by AS2001.2.19 of 230 newtons. The product was also found to have an edge tear resistance value as measured by AS4200.1 of 130 newtons in both the machine and lateral directions of the laminate product.

25 Figure 2 illustrates an alternative embodiment wherein an aluminium vacuum deposit is used instead of a foil layer. It includes aluminium deposit layer (6), oriented polyester or polypropylene layer (4), adhesive layer (3) and a polyethylene layer (5).

As an aluminium vacuum deposit is used instead of a foil layer, an extra layer of adhesive is not required. The overall construction and weight of this laminate is as follows:

30 aluminium deposit layer - 1 gram per square metre;
oriented polyester or polypropylene layer - 17 grams per square metre;
adhesive layer - 3 grams per square metre;
polyethylene layer - 40 grams per square metre;
TOTAL - 61 grams per square metre.

polyethylene film are fed into a web fed laminating machine and laminated together. The nip rollers of the laminating machine are heated to 70°C to enhance the bond between the PET layer and polyethylene layer. The PET/foil layer and blown polyethylene layer are fed into the laminating machine in substantially the same direction as the laminate exits the machine so that the machine direction of the PET film and blown polyethylene film in the laminate extend in the same direction and in the same direction as the machine direction of the laminate sheet itself.

To install the reflective laminate product of this invention, the laminate sheet can be affixed to the frame of the walls or the rafter or joists of a roof by nails, staples or the like.

The advantage of the present insulation sheet of this invention over known reflective insulation sheets is that it is light weight yet strong. A further advantage of the insulation sheet of this invention is that it need not include a paper layer. Accordingly, the insulation may function as a vapour barrier and water barrier, and is resistant to wetting.

Finally, it is understood that various alterations, modifications and/or additions may be introduced into the construction and arrangement of the insulation sheet previously described without departing from the spirit or ambit of the invention.

oriented polyester film, oriented polypropylene film, oriented nylon film, cast polypropylene film and cast polyvinylchloride film.

9. The laminated sheet according to claim 8 wherein the oriented polyester film is made from polyethylene terephthalate.

5 10. The laminated sheet according to any one of the preceding claims wherein the second polymeric material is selected from the group of polymeric materials consisting of blown or cast polyethylene film, blow or cast polyethylene/polypropylene copolymer film, ethylene vinylacetate film, copolymer nylon film, ionomer film, acid copolymer film and plasticised polyvinylchloride film.

10 11. The laminated sheet according to claim 10 wherein the layer of second polymeric film is blown polyvinylchloride film.

12. The laminated sheet according to any one of the preceding claims wherein the sheet has a bursting force value of greater than 200 Newtons and an edge tear resistance value of more than 45 Newtons.

15 13. The laminated sheet according to any one of the preceding claims wherein the laminated sheet includes a further layer that confers the specified infrared emittance property on the laminated sheet, the further layer being a metal foil layer or a metallised deposit layer.

20 14. The laminated sheet according to any one of the preceding claims wherein the sheet includes a reinforcing fabric layer.

15. A reflective insulation laminate sheet including:

(1) a layer of aluminium foil having a weight of about 17 grams per square metre;

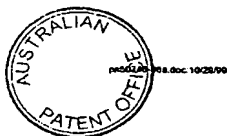
(2) an adhesive layer;

25 (3) a layer of polyethylene terephthalate film having a weight of between 15 to 25 grams per square metre;

(4) an adhesive layer; and

30 (5) a layer of blown polyethylene film having a weight of between 25 to 50 grams per square metre, the blown polyethylene film including a colorant and matting agent;

wherein the overall weight of the laminated sheet does not exceed 180 grams per square metre.



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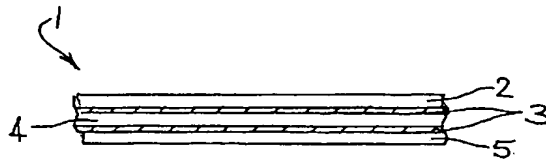


FIG 1

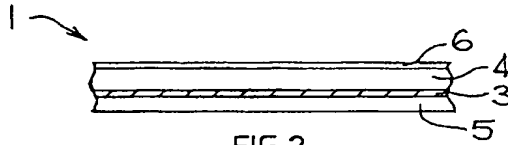


FIG 2

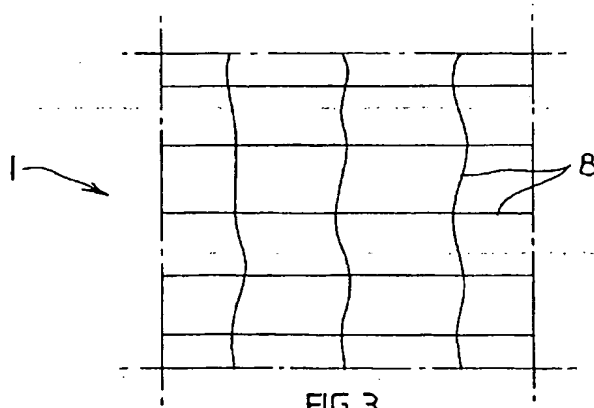


FIG 3

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